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ABSTRACT

This paper has three focuses: it summarizes the overall trends and issues in educational computing research; it assesses the problems and promise of educational technology in plans for school restructuring and reform; and it draws implications from these perspectives for teacher education. The research review is organized into four categories: trends and issues in educational computing, computers' inability to function as a panacea for troubled schools, teacher attitudes and beliefs, and restructuring schools and technology. Examination of the literature suggests that: (1) computers cannot replace good teaching; (2) no clear-cut conclusions about the impact of computer use in the classroom can be drawn; (3) teachers are critically important in classroom computer use; (4) teachers' traditional beliefs may inhibit them from taking instructional risks and implementing technological innovations; (5) computers can be an important component of an active learning environment; (6) educational technology can be a change agent and catalyst for school restructuring; and (7) teaching is generally complicated through the use of technology in the classroom. The paper concludes that both inservice and preservice education should place technology near the center of learning and curricular improvements. (IAH)

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Technology, Teachers, Educational Reform: Implications for Teacher Preparation

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Technology, Teachers, Educational Reform: Implications for Teacher Preparation

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This paper has three focuses: First, to summarize the overall trends and issues in the research on educational computing; secondly, to assess the problems and promise of educational technology in plans for school restructuring and reform; and lastly, to draw implications from these perspectives for teacher preparation.

Trends and Issues in Educational Computing

Collis, B. (1990). *The best of research windows: Trends and issues in educational computing*. Eugene, Oregon: International Society for Technology in Education.

It is difficult to evaluate present and future directions in educational technology without reviewing past performances. From 1985 to 1989 Betty Collis wrote *Research Windows*, a column in *The Computing Teacher*, on trends and issues in educational computing. Her purpose was to identify well-done research studies that had particular relevance to the classroom teacher. If imitation is the sincerest form of flattery, I owe a debt of gratitude to Collis' perceptive and selective eye in providing a model for organizing and interpreting the educational technology literature.

Collis reviewed over 180 studies and synthesized her research into four basic areas: curriculum-related instructional support, computer impact on other learning focuses, software, and, teacher-focused studies. The abstracts and comments on this literature are still fresh and appealing, in part, because innovations in educational computing and technology have been slow to fulfill their initial potential in the schools.

Collis' beliefs and generalizations about educational computing changed little over the four years that she wrote the column. She observed:

> There are no easy answers or simple conclusions about the impact of computer use in education.
>
> Teachers are critically important in whatever happens whenever computers are used (or not used) in education.
>
> Classroom implementation of computer use is typically a challenging task.
>
> Computers have been and continue to be remarkable catalysts for educational excitement, self-examination and growth.
>
> (p. 18)

The last point may be the most important of all. With the encouraging but ambiguous nature of these conclusions, it is easy to understand why the media has been quick to label the promise of educational computing as, "the revolution that fizzled" (Elmer-Dewitt, 1991).

A Fizzled Revolution?

Elmer-Dewitt, P. (1991, May 20). Education: The revolution that fizzled. *Time*. pp. 48-49.

In this feature article, computers as the savior and panacea for today's troubled schools get soundly romped. As it should be. Computers were never intended to replace good teaching but rather to supplement and facilitate what good teachers can do to meet students' educational needs. It appears that both the public and the teachers were lead to believe that innovating with technology would be less difficult and less time consuming than has proven to be the case.

Some excellent learning outcomes have resulted from computer innovation in the classroom, but these clear-cut successes are few and far between. The article reports that technologically successful teachers had five to six years experience and practice in

teaching with computers, free-form classrooms with in-class computers and extended class periods, hands on learning, and teachers serving as coaches and facilitators of student learning. This is not the typical classroom paradigm of the nineties, which is teacher directed, print driven, and organized into 50 minute periods by content area and subject to annual standardized tests to measure learning.

There are concerns about technological inequity, a situation in which students in wealthy school districts get a dispositional amount of hardware and software compared to students in poor districts who may do without. However, technology may be too much of a good thing if computers replace good teachers and teaching, a concern voiced by popular educational games creator Tom Synder, who fears that, " In the year 2000, poor, black inner-city kids are going to be taught by computers while rich white kids in the suburbs get human teachers (p. 49)." This suggests that some see computers used as teacher surrogates for the very neediest of students who exhibit fewer teacher pleasing behaviors and are difficult to teach.

It is not too late, according to Elmer-Dewitt, to redeem the failure of technology to transform America's struggling schools. He suggests that teachers be given greater autonomy and accountability in their classrooms for their students in reaching educational goals. Standard assessment procedures may be inadequate measures by which to judge innovative curriculums. Teachers also need the time and freedom to restructure their curriculum around technology.

Presently, technologically minded teachers often become discouraged as they see their support and financial resources wane for lack of spectacular learning gains on standardized tests. "Expect to wait five or six years for real change," recommends Elmer-Dewitt. Unfortunately, many administrators, parents and students feel that they have waited long enough.

Teachers Attitudes and Beliefs

Dwyer, D., Ringstaff, C. and Sandholtz, J. (1991). Changes in teachers' beliefs and practices in technology-rich classrooms. *Educational Leadership*, *48*(8), 45-52.

This is an excellent article for articulating the difficulties teachers face in integrating technology in their classroom under the best of circumstances. The 32 teachers in this study volunteered to participate in the Apple Classrooms of Tomorrow (ACOT) project funded by Apple Computer and directed and supported by ACOT staff. The espoused goal was a change in teacher instruction and student learning.

Teacher reactions and struggles with computer technology and curricular innovation over a four year period were chronicled. The teachers were supported at each step with "a critical mass of technology", software, training, and flexible administrative scheduling. What teachers discovered was that their traditional beliefs and experiences with schooling inhibited them from taking instructional risks and implementing technological innovations in the classroom.

The results: there were no clear cut short term efficacious computer interventions. However, participants were "more disposed to view learning as an active, creative, and socially interactive process than they were when they entered the program" (p. 50). The authors found that it was critical to take a long view and see technology as both a process and a commitment leading to instructional evolution rather than a quick fix.

Such a view would involve rethinking the way teachers are trained, in-serviced and supported in the classroom. Many educational critics suggest that schools are in need of rethinking and restructuring the way instruction is provided to meet the diverse learning needs of today's students. Perhaps the only way that technology can succeed in the schools as it does in the work place is to be "built" into the curriculum as an essential and central element of the instructional delivery system.

Restructuring Schools and Technology

Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. *Phi Delta Kappan, 73*(1), 17-27.

Collins, A. (1991). The role of computer technology in restructuring schools. *Phi Delta Kappan, 73*(1), 28-36.

David, J. (1991). Restructuring and technology: Partners in change. *Phi Delta Kappan, 73*(1), 37-40, 78-82.

This trinity of articles speaks to the concerns voiced in the prior three readings. But the underlying thrust of these articles is that for students to meet the educational goals set out by President Bush for all school children by the year 2000 (readiness to learn, higher levels of high school graduation, world leaders in math and science achievement) requires a different set of assumptions about learning and schooling than presently popularly exist. Learning needs to be student-centered and constructionist rather than teacher-centered and didactic. Teaching needs to be adventurous and innovative to support active learning and problem-solving in the classroom. School needs to be meaningful and relevant to students' lives.

Sheingold acknowledges that traditional assumptions about learning and teaching are presently under revision. She suggests that future learning activities need to be qualitatively and qualitatively different than those now in place in the schools; not more of the same material, taken at a slower pace, or with continuous repetition resulting in rote learning.

A similar argument has been made in the past for remedial reading activities and learning disabilities tutorials. When students were unsuccessful learning in the classroom through traditional instruction, learning could be significantly improved when students were taught through their strengths in alternative methods. Unfortunately, individualizing remedial instruction for the "best fit" is often a time consuming trial-and-

error process. Similar problems beset school restructuring and innovating instruction through technology.

One suggestion would involve wedding the agendas of active learning, technology and restructuring together in supportive rather than competitive roles. Sheingold makes the argument that each of these items has been valued in education but pursued independently -for their own sake- and not imbedded in a common content or tied to a common set of goals.

She believes that only through synergy can any of these items hope to make a lasting positive impact in transforming teaching and learning.

Collins, on the other hand, views computers as tools for learning. He believes that technological innovation and computer usage in the schools will flourish only to the degree that the need for tools provides a rationale for buying and using computers.

Fears that computers will fail in the schools, the costs, technical unreliability and teachers unfamiliarity with computers will become nonissues over time, says Collins. As computer usage continues to proliferate in the work place and in the home, more people will naturally use computers, computer technology will only continue to get better and costs will decrease. He cites wide-spread video usage as a prime example of this process.

Any restructuring in the schools, according to Collins, will take place over an extended period of time. He also takes the long view and believes the restructuring will not be not be an all or nothing proposition and suggests targeting areas in which sustained efforts would be worthwhile.

Not all schools and subject areas should be or need to be fixed. Changes will occur but not to the degree or immediacy that some school reformers advocate.

Collins' position is consistent with the literature on change; systemic changes often take years to implement and even longer to see any obtainable results. Delegating change at a predetermined rate for predetermined goals will ring false to some teachers

who are reluctant to trade what they already know for the unknown. Real change occurs on an "as need" basis when all partners are in agreement and have the time and foresight to plan, implement, test, modify, and assess again.

Davis believes that restructuring in the schools may succeed because change is systemic and focuses on desired educational results rather than a list of procedures to "fix" particular problems. Again, we are talking about a system in which students are active participants in their learning and teachers are their learning coaches and facilitators; where content learning goals may replace specific course requirements, and student achievement portfolios may replace grades.

Several constraints also influence the ability of the system to change: college admissions criteria, accreditation, certification, licensing standards, preparation programs for teachers and administrators, and tests and textbooks adopted.

Davis offers a set of essential conditions for restructuring schools: an invitation to change; decentralization of authority and flexibility; access to new knowledge and training; and, time. She sees technology's role as that of a change agent and catalyst in advancing these preconditions to restructure schools.

Technology can invite change by providing teachers with both the occasion and opportunity for hands on computer skills, collaboration, problem solving, and instructional innovation and support in the classroom. Computers are also a visible and obvious symbol that learning and teaching has changed. Technology can also help reallocate existing resources in the classroom.

Teaching, however, in not simplified through the use of technology and complicates teachers' jobs enormously. Teachers must not only know how to use technology but they also must know how to teach differently and assume and communicate new roles for themselves and their students.

Just as there are no short cuts to integrating technology in the classroom, there is no turning back. With Collis we celebrated the promise and successes of educational

computing; with Elmer-Dewitt we looked at the road ahead through the media's lenses. Dwyer et. al. offered a view of integrating technology through teachers' and researchers eyes.

Sheingold suggested that technology and active learning be an integral part of restructuring schools; Collins viewed computers as instructional tools that could eventually make teachers' jobs easier and lead to a more constructionist view of education; Davis articulated the role of technology as that of an educational change agent and the resultant difficulties in changing the present educational system to a potentially more productive one.

Implications for Teacher Preparation

The implications for teacher education seem clear. Preservice teachers need to receive hands-on experience with computers and technology in professional educational environments as they support a variety of teaching methods in specific content areas. Active learning strategies such as cooperative learning and problem-solving need to be modeled and imbedded, not just mentioned, in course content. In-service activities for teachers in educational technology must be meaningful, systematic and on-going.

Exciting and innovative applications of technology to improve teaching and learning are possible, but only if the educational community places technology near the center, rather than on the periphery, of learning and curricular improvements. At the present time there appear to be few institutional incentives for teacher educators or preservice teachers to be "up to speed" with new technologies; those having individual expertise are often undervalued or worse, ignored. Lack of time, hands on experience, and available of hardware, softwear, and technological support often daunt the most enthusiastic of teacher educators.

There are many wonderful teacher preparation programs that are leading the vanguard in training our preservice teachers in technology for the 21st century. However, they are the exception rather than the rule. We need to learn from them, and from each other, if we are truly to incorporate the best of what we know in teacher preparation and practice.